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Guide for Determining Compliance with the Clean Air Act Standards for Radionuclide Emissions from NRC-Licensed and Non-DOE Federal Facilities. (Revision 1)

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This report provides guidance for determining compliance with one of the National Emission Standards for Hazardous Air Pollutants (NESHAPs) covering facilities not operated by the DOE, that could emit Radionuclides to the Air. (40 CFR 61, Subpart I)

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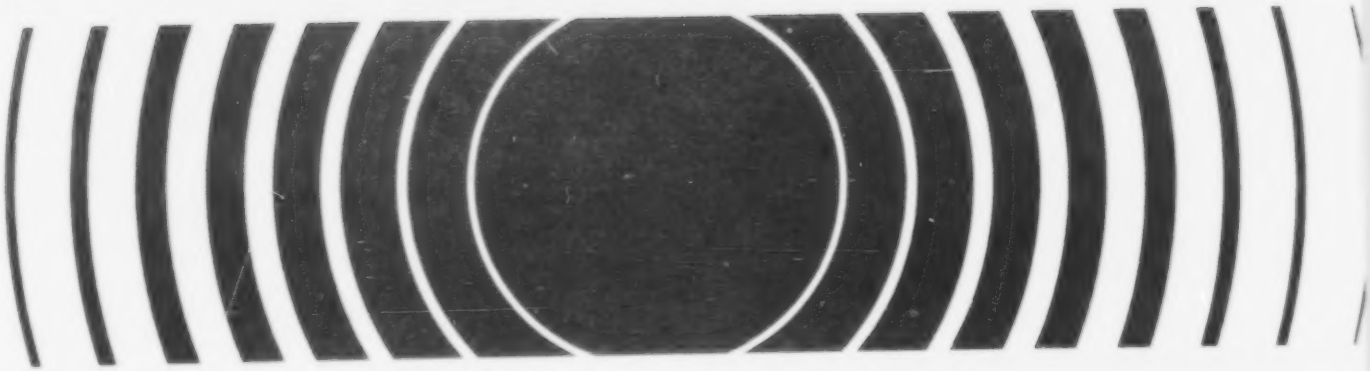

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A GUIDE FOR DETERMINING COMPLIANCE WITH THE CLEAN AIR ACT STANDARDS FOR RADIONUCLIDE EMISSIONS FROM NRC-LICENSED AND NON-DOE FEDERAL FACILITIES

(Revision 1)

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Radiation Programs
401 M Street, S.W.
Washington, DC 20460

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TABLE OF CONTENTS

	Page
1. INTRODUCTION	1-1
1.1 Applicability	1-1
1.2 Background and Purpose	1-1
1.3 How to Use This Guidance Document	1-3
2. DETERMINING EXEMPTION AND DEMONSTRATING COMPLIANCE	2-1
2.1 Introduction	2-1
2.2 Choosing a Procedure	2-1
3. WORKSHEETS	3-1
Worksheet A - NESHAPS Applicability	3-2
Worksheet B - Possession Table	3-4
Worksheet C - Concentration Table	3-21
Worksheet D - Stack or Vent Characteristics	3-31
Worksheet E - Release Rates	3-35
Worksheet F - NCRP Commentary No. 3	3-43
4. REPORTING AND RECORDKEEPING REQUIREMENTS	4-1
4.1 Reporting Requirements	4-1
4.2 Recordkeeping Requirements	4-4
5. RESOLVING PROBLEMS AND CONTACTING THE EPA	5-1
5.1 EPA Contacts	5-1
5.2 Sources	5-1
REFERENCES	

LIST OF FIGURES

	Page
3-1. Distance Between Source and Nearest Receptor or Farm	3-45
3-2. Definition of Release Heights	3-46
5-1. EPA Regional Offices	5-2

LIST OF TABLES

2-1. Input Parameters Required for Various Methods	2-6
3-1. Annual Possession Quantities for Environmental Compliance	3-9
3-2. Concentration Levels for Environmental Compliance	3-25
3-3. Adjustments to Emission Factors for Effluent Controls	3-41
5-1. EPA Regional Program Managers	5-3

1. INTRODUCTION

1.1 APPLICABILITY

The requirements described in this document apply to certain facilities licensed by the Nuclear Regulatory Commission (NRC) or its Agreement States to handle radioactive materials. Federal facilities not part of the Department of Energy (DOE) are also covered.

You may not be subject to these requirements. If you are uncertain, fill out Worksheet A in Section 3 to determine whether the requirements apply. If you are not subject to the requirements, you need read no further.

1.2 BACKGROUND AND PURPOSE

On February 6, 1985, the Environmental Protection Agency (EPA) issued standards under Section 112 of the Clean Air Act that limit airborne emissions of radionuclides to the atmosphere. In February 1989 these standards were re-proposed, and in November 1989 final standards may be promulgated. This document provides guidance for determining compliance with one of the National Emission Standards for Hazardous Air Pollutants (NESHAPS) covering facilities that are licensed by the NRC, and Federal facilities not operated by the DOE, that could emit radionuclides to the air. See the Code of Federal Regulations, Title 40, Part 61, Subpart I (40 CFR 61, Subpart I).

Facilities covered by Subpart I should use this document. They include all Federal facilities that emit radionuclides to the air (except those owned or operated by the DOE), and all facilities licensed by the NRC or its Agreement States. The proposed standard does not apply to disposal at facilities under 40 CFR Parts 191 subpart B*, to facilities that use only sealed radiation sources, or to low energy accelerators. Examples of the types of facilities covered include radiopharmaceutical suppliers and users, shipyards, research facilities, test and research reactors, radiation source manufacturers, and power reactors under the uranium fuel cycle.

The standard requires that existing facilities file an annual report with the EPA. It also requires that an application to construct or modify be filed with the EPA for new facilities or proposed modifications to existing facilities. In most cases, you will be exempt from reporting or filing an application with the EPA if your facility's emissions lead to calculated doses that are a factor of ten lower than the standard.

The EPA has developed methods for you to use to determine whether your facility is in compliance with 40 CFR Part 61, Subpart I, and whether it is exempt from reporting. The overall approach is a tiered set of methods intended to minimize the burden on those facilities covered by the standard. This approach begins with simple-to-use methods that are very conservative in terms of determining compliance. The methods become progressively less conservative but more complicated at succeeding levels.

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* Part 191 deals with high-level and transuranic waste and spent fuel.

If you cannot demonstrate compliance with the standard by using any of the methods described in Section 3, you should contact the EPA Radiation Representative at your regional EPA office. (See Section 5.)

1.3 HOW TO USE THIS GUIDANCE DOCUMENT

The remainder of this document gives the details of this tiered approach. Each method is keyed to a worksheet. These worksheets explain the purpose of the relevant step and list useful references. They also list the data you will need and provide a step-by-step procedure for determining whether your facility is in compliance with the standard and whether you need to report to the EPA. Section 2 briefly describes each method and the assumptions on which it is based. The worksheets are in Section 3. Section 4 contains a summary of reporting and recordkeeping requirements, and Section 5 discusses when and how to contact the EPA to resolve any problems or issues specific to your facility.

2. DETERMINING EXEMPTION AND DEMONSTRATING COMPLIANCE

2.1 INTRODUCTION

This section outlines the methods used to determine if you are covered by the standard, if you comply with the requirements, or if you are exempt from reporting.

Begin by completing Worksheet A to see whether you are subject to the requirements. If you are exempt from the requirements, you need go no further.

To determine whether you comply with the standard and are exempt from reporting, or whether you comply but must report, you must estimate the radiation dose to the nearest receptor (resident, home, school, business, or office) as a result of airborne emissions of radioactivity from your facility. This section describes the methods approved by the EPA for making such dose estimates. There are several approaches because of the diversity of facilities regulated under the standard. The simplest methods do not estimate the radiation dose directly. Instead, they determine whether your emissions could not cause a dose greater than the standard.

2.2 CHOOSING A PROCEDURE

This section describes four alternative procedures for determining compliance with the standard. A very brief description of all the methods and the assumptions on which they are based follows. However, you should first check Table 3-1 or 3-2 to see if the radionuclides that

you are using are handled by COMPLY. If they are not, contact your EPA Radiation Representative listed in Table 5-1.

Possession Table - Procedure #1

The Possession Table allows you to determine compliance from the amount of radionuclides used annually at your facility. You should use this method if you handle only small quantities and you do not have measured stack concentrations. The annual quantities were calculated using assumptions that tend to overestimate the dose. This procedure may be used to determine exemption from reporting and to demonstrate compliance. See the instructions for Worksheet B for the restrictions on using this method.

Concentration Table - Procedure #2

You should use this approach if you have measured stack concentrations or have EPA approval to measure air concentrations at the receptor. The approach is generally based on the concentration of radionuclides in the emissions. For each radionuclide, the concentration limit ensures that a person exposed to that concentration for a full year would not receive a dose that exceeds the standard. This method assumes no dispersion from the point of release to where the most exposed person lives and assumes that all of the person's food is grown at his home. This procedure may be used to determine exemption from reporting and to demonstrate compliance. See the instructions for Worksheet C for the restrictions on using this method.

Screening Model - Procedure #3

This method consists of three screening levels. You should use this approach if you cannot satisfy the requirements using the possession or concentration tables. This method requires that you develop a small amount of site-specific data (quantities of nuclides released, the facility's physical configuration, and distance to the nearest person from the point of release). Detailed radionuclide, meteorological, and demographic information is not needed because the dose factors and dispersion models incorporate assumptions that tend to overestimate the dose. This method may be used to determine exemption from reporting or filing and to demonstrate compliance. At present, NCRP Commentary No. 3 provides procedures for calculating organ doses as well as effective whole body dose equivalents. Organ doses are not required to demonstrate compliance.

You may either do the calculations by hand or use the COMPLY computer code. If you use the Screening Model, you will need to fill out Worksheets D and E and obtain either the User's Guide for the COMPLY code or National Council on Radiation Protection and Measurements (NCRP) Commentary No. 3. (See Section 5 for information on how to obtain these documents and the code.) Table 2-1 lists the parameters you will need to do the calculations in NCRP Commentary No. 3, and for input into the COMPLY code. If you use NCRP Commentary No. 3, or the COMPLY code, you will also need to fill out Worksheet F.

Compliance Model - Procedure #4

The Compliance Model is an extension of the NCRP Screening Levels but produces a more accurate dose estimate by providing for more complete treatment of air dispersion, and a separate location for the production of each type of food. In addition, the pathway parameters are less conservative. This greater precision requires some additional site-specific data. This method is the highest level in the COMPLY computer code. If you use this method, you will need to fill out Worksheets D and E and obtain the COMPLY code and its user's guide. (See Section 5 for information on how to obtain these.) You will also need to fill out Worksheet F.

Table 2-1 is a list of the parameters you need at various levels for the NCRP Screening Levels and the COMPLY code. Not all parameters are needed at all levels; the need is determined by the particular configuration of your facility. The footnotes to Table 2-1 briefly describe when a particular parameter is needed. A precise definition of each of these parameters is given in the User's Guide for the COMPLY Code.

Use of the COMPLY Code

The first three procedures can be done either by hand following the steps of NCRP Commentary No. 3, or by means of the COMPLY computer code. See Worksheet F. It is not practical to do by hand the complicated calculations in Procedure #4 which is contained in the COMPLY code. However, only facilities that handle and release radionuclides having the potential to cause doses greater than 10% of the standard will need to use this method.

The COMPLY code runs on an IBM PC or PC-compatible computer and has been designed for users with limited computer experience. The program will ask you for the information it needs and will produce most of the report for you. You must decide initially which of the methods to use, but the program does all the numerical calculations. Thus, if your initial choice of method is inappropriate, you have lost only a few minutes of time, not several hours.

If your facility handles more than about six nuclides or has multiple release points (stacks or vents), we recommend using the COMPLY code. Doing the calculations for multiple nuclides or release points by hand can become very difficult.

The initial choice of one method does not preclude you from using another method, provided that you have the necessary information and you meet the restrictions associated with that method.

Table 2-1. Input parameters required for various methods

Parameter	NCRP Level	COMPLY Level	Default Value
Nuclide names	1-3	1-4	None
Stack concentrations	N/A	1	None
Annual possession amounts	N/A	1	None
Release rates	1-3	2-4	None
Release height	2-3	2-4	None
Building height	2-3	2-4	None
Stack or vent diameter[A]	2-3	2-4	None
Volumetric flow rate[A]	1-3	2-4	0.3 m^3/s
Distance from source to receptor	2-3	2-4	None
Building width[B]	2-3	2-4	None
Wind speed[C]	2-3	2-4	2 m/s
Distances to sources of food production (farms)[D]	2-3	3-4	None
Stack temperature[E]	N/A	4	55°F
Ambient air temperature[E]	N/A	4	55°F
Wind rose[F]	N/A	4	None
Building length[G]	N/A	4	None

Notes:

A. Needed at levels 2 and 3 only if source and receptor are on the same building. Needed at level 4 if source and receptor are on the same building or if stack height is more than 2.5 times building height.

B. Needed only if stack height is less than or equal to 2.5 times building height.

C. At level 4, needed only if user has not specified a wind rose.

D. At level 3, there are two farms--one for vegetables and one for milk and meat. At level 4, there are three farms--one each for vegetables, milk, and meat.

E. Needed if stack height is more than 2.5 times building height.

F. Optional.

G. Needed only if stack height is less than or equal to 2.5 times the building height and the user has specified a wind rose.

WORKSHEETS

The following worksheets provide a step-by-step approach to each method described in Section 2. Each worksheet on the following pages contains a list of the parameters needed to complete the worksheet and line-by-line instructions.

Note: If you use the COMPLY code, you need not fill out Worksheets B and C.

The worksheets shown here have space for only three nuclides. If your facility handles more than three, we suggest you make your own worksheets using these as guides. On each page, be sure to identify the worksheet number, your facility name, and the assessment period (one calendar year for existing facilities, and a one-year period for facilities not yet constructed), and use the same line numbers as those on the worksheets given here.

WORKSHEET A - NESHAPS Applicability

INTRODUCTION

Sections 61.100 and 61.101 of 40 CFR Part 61, Subpart I, define the facilities covered by this standard. The questions on Worksheet A provide a step-by-step procedure to determine whether your facility is covered. The standard applies to existing facilities, modifications to existing facilities, and new or proposed facilities. Check the proper "yes" or "no" space for each question and follow the related instruction.

EXPLANATION OF WORKSHEET A ITEMS

1. Self-explanatory.

2. Facilities owned or operated by an agency of the Federal Government (other than the Department of Energy) include those operated by contractors to those agencies.

3. Part 191 deals with high-level and transuranic waste and spent fuel.

4. Only unsealed sources are covered under this rule, and a source is considered to be sealed unless opened. "Special Form" sources are exempt as are any sealed sources that are sealed and not intended to be opened in their routine application (e.g., thickness gauges).

5. Self-explanatory.

WORKSHEET A - NESHAPS Applicability

Facility Name: _____

Assessment Period (dates): _____

1. Does your facility have a license issued by the NRC or any Agreement State to receive title to, receive, possess, use, transfer, or deliver any source, byproduct, or special nuclear material?

Yes _____:	Go to Step 3
No _____:	Go to Step 2

2. Is your facility owned or operated by an agency of the Federal Government other than the Department of Energy?

Yes _____:	Go to Step 3
No _____:	Stop. You are not covered by this subpart I of this rule.

3. Is your facility engaged in disposal under 40 CFR Part 191 subpart B or do you operate only a low-energy accelerator?

Yes _____:	Stop. You are not covered by this rule.
No _____:	Go to Step 4

4. Does your facility handle sealed radiation sources exclusively?

Yes _____:	Stop. You are not covered by this rule.
No _____:	This rule does apply to your facility. Go to Step 5.

5. You are subject to EPA's radionuclide air emission standard. Section 2 of this document explains how to determine exemption from reporting, and how to demonstrate compliance with the standard.

WORKSHEET B - POSSESSION TABLE

INTRODUCTION

The Possession Table provides a simple method for determining if you are in compliance with the standard and exempt from reporting. You may use the Possession Table only if your facility meets both of the following conditions:

1. There is no receptor within 10 meters* of any release point; and

2. No milk, meat, or vegetables are produced within 100 meters* of any release point.

If you do not meet both of these conditions, use another method (see Section 2.2). If you do meet these conditions and wish to use the Possession Table, you will need the following information:

1. A list of all radionuclides used in your facility during the reporting period.

2. The amount (in curies) of each radionuclide you had on hand at the beginning of the reporting period.

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*This is the straight-line distance determined from a plan view. See Figure 3-1 at the end of this Section.

3. The amount (in curies) of each radionuclide that you received at your facility during the reporting period.

4. The physical form (gas, liquid or powder, or solid*) of each radionuclide and the maximum temperature to which it is exposed in your facility.

Given this information, use Worksheet B to determine if you are in compliance or exempt from reporting. Or, you may use the computer program COMPLY. See the User's Guide for the COMPLY Code (EPA89a).

EXPLANATION OF WORKSHEET B ITEMS

1. If a nuclide is in more than one physical form (gas, liquid or powder, or solid), enter its name once for each form. See item 5 below for restrictions on these forms.

2. This is the amount of each nuclide (in curies) contained in inventory at the beginning of the assessment period. Any material in sealed containers that were not opened during the assessment period, and did not leak, should not be included.

3. This is the amount of each nuclide (in curies) received at the facility during the assessment period. Any material in sealed containers that were not opened throughout the assessment period, and did not leak, should not be included.

*Capsules containing radionuclides in liquid or powder form can be considered to be solids.

4. Self-explanatory.

5. This must be a gas, a liquid or powder, or a solid. If any nuclide is exposed to a temperature of 100 degrees Celsius or more, or boils at a temperature of 100 degrees Celsius or less, it must be considered to be a gas. Any nuclide that is intentionally dispersed into the environment must be considered to be a gas; for example, radioactive tracers that are released into wells or rivers to determine ground water flow.

6. Table 3-1 lists the annual possession quantity for each nuclide by name and by physical form. Find the nuclide name and enter the number given in the column corresponding to its physical form on line 5. If you use radionuclides that are not on this list, contact the EPA.

7. This is the ratio of your amount to the annual possession quantity.

8. This is the sum of all the ratios on line 7.

9. This is the sum of the ratios from line 7 for radioiodines.

WORKSHEET B - POSSESSION TABLE

Facility Name: _____

Assessment Period (dates): _____

1. Enter the name of each nuclide (i.e., I-131, Co-60, etc.). If a nuclide is in more than one physical form, enter its name once for each physical form.	_____	_____	_____
2. Enter the curies on hand at the beginning of the period.	_____	_____	_____
3. Enter the curies produced or received during the period.	_____	_____	_____
4. Add lines 2 and 3.	_____	_____	_____
5. Enter the physical form of the nuclide- gas, liquid or powder, or solid or capsule (G, L, or S). If any nuclide is exposed to temperatures of 100 ^{o}C or more, or boils at 100 ^{o}C or less, treat it as a gas.	_____	_____	_____
6. Enter the value shown in Table 3-1 for the appropriate form of each nuclide.	_____	_____	_____
7. Divide line 4 by line 6.	_____	_____	_____
8. Sum the fractions on line 7.		_____	
9. Sum the fractions on line 7 due to radioiodines.		_____	

WORKSHEET B (page 2 of 2)

If the value on line 8 is less than 0.1 and the value on line 9 is less than 0.03 and both represent the dose caused by the entire facility with any new construction or modification, you are exempt from reporting or submitting an application to construct or modify. If the value on line 8 is less than 0.01 and the value on line 9 is less than 0.003 and both represent the dose caused only by any new construction or modification, you are exempt from applying for an application to construct or modify that would otherwise be required under 40 CFR 61, Subpart I. Retain this worksheet for possible review by the EPA.

If the value on line 8 is equal to or greater than 0.1 but less than or equal to 1.0, and the value on line 9 is equal to or greater than 0.03 but less than or equal to 0.3, you are in compliance but are not exempt from reporting to the EPA. If the value on line 8 is equal to or greater than 0.01 and the value on line 9 is equal to or greater than 0.003 and both represent the dose caused only by any new construction or modification, you are not exempt from reporting to the EPA. You may, if you like, use a different method to determine if you are exempt. Retain this worksheet for possible use later.

If the value on line 8 is greater than 1.0, or the value on line 9 is greater than 0.3, you have not demonstrated compliance. You should use another method to determine if you can meet the standard.

Table 3-1 Annual Possession Quantities for Environmental Compliance

Radionuclide	Annual Possession Quantities (Ci/yr) Gaseous Form*	Liquid/ Powder Forms	Solid Form*
Ac-225	9.6E-05	9.6E-02	9.6E+01
Ac-227	1.6E-07	1.6E-04	1.6E-01
Ac-228	3.4E-03	3.4E+00	3.4E+03
Ag-106	1.6E+00	1.6E+03	1.6E+06
Ag-106m	2.6E-03	2.6E+00	2.6E+03
Ag-108m	6.5E-06	6.5E-03	6.5E+00
Ag-110m	9.4E-05	9.4E-02	9.4E+01
Ag-111	6.7E-02	6.7E+01	6.7E+04
Al-26	4.0E-06	4.0E-03	4.0E+00
Am-241	2.3E-06	2.3E-03	2.3E+00
Am-242	1.8E-02	1.8E+01	1.8E+04
Am-242m	2.5E-06	2.5E-03	2.5E+00
Am-243	2.3E-06	2.3E-03	2.3E+00
Am-244	4.6E-02	4.6E+01	4.6E+04
Am-245	7.0E+00	7.0E+03	7.0E+06
Am-246	9.8E-01	9.8E+02	9.8E+05
Ar-37	1.4E+06	-	-
Ar-41	1.4E+00	-	-
As-72	2.9E-02	2.9E+01	2.9E+04
As-73	6.0E-02	6.0E+01	6.0E+04
As-74	4.3E-03	4.3E+00	4.3E+03
As-76	8.8E-02	8.8E+01	8.8E+04
As-77	7.9E-01	7.9E+02	7.9E+05
At-211	1.0E-02	1.0E+01	1.0E+04
Au-193	4.2E-01	4.2E+02	4.2E+05
Au-194	3.5E-02	3.5E+01	3.5E+04
Au-195	3.3E-03	3.3E+00	3.3E+03
Au-198	4.6E-02	4.6E+01	4.6E+04
Au-199	1.5E-01	1.5E+02	1.5E+05
Ba-131	1.0E-02	1.0E+01	1.0E+04
Ba-133	4.9E-05	4.9E-02	4.9E+01
Ba-133m	9.3E-02	9.3E+01	9.3E+04
Ba-135m	5.8E-01	5.8E+02	5.8E+05
Ba-139	4.7E+00	4.7E+03	4.7E+06
Ba-140	2.1E-03	2.1E+00	2.1E+03

See footnotes at the end of the table.

Table 3-1 Annual Possession Quantities for Environmental Compliance (continued)

Radionuclide	Annual Possession Quantities (Ci/yr) Gaseous Form*	Liquid/ Powder Forms	Solid Form*
Ba-141	1.3E+00	1.3E+03	1.3E+06
Ba-142	1.1E+00	1.1E+03	1.1E+06
Be-7	2.3E-02	2.3E+01	2.3E+04
Be-10	3.0E-03	3.0E+00	3.0E+03
Bi-206	3.1E-03	3.1E+00	3.1E+03
Bi-207	8.4E-06	8.4E-03	8.4E+00
Bi-210	4.2E-03	4.2E+00	4.2E+03
Bi-212	4.7E-02	4.7E+01	4.7E+04
Bi-213	6.0E-02	6.0E+01	6.0E+04
Bi-214	1.4E-01	1.4E+02	1.4E+05
Bk-249	7.0E-04	7.0E-01	7.0E+02
Bk-250	1.0E-01	1.0E+02	1.0E+05
Br-77	7.5E-02	7.5E+01	7.5E+04
Br-80	1.2E+01	1.2E+04	1.2E+07
Br-80m	1.5E+00	1.5E+03	1.5E+06
Br-82	1.6E-02	1.6E+01	1.6E+04
Br-83	9.9E+00	9.9E+03	9.9E+06
Br-84	5.6E-01	5.6E+02	5.6E+05
C-11	1.3E+00	1.3E+03	1.3E+06
C-14	2.9E-01	2.9E+02	2.9E+05
Ca-41	2.7E-02	2.7E+01	2.7E+04
Ca-45	5.8E-02	5.8E+01	5.8E+04
Ca-47	1.1E-02	1.1E+01	1.1E+04
Cd-109	5.0E-03	5.0E+00	5.0E+03
Cd-113	3.3E-04	3.3E-01	3.3E+02
Cd-113m	4.4E-04	4.4E-01	4.4E+02
Cd-115	5.4E-02	5.4E+01	5.4E+04
Cd-115m	1.0E-02	1.0E+01	1.0E+04
Cd-117	5.6E-02	5.6E+01	5.6E+04
Cd-117m	1.3E-01	1.3E+02	1.3E+05
Ce-139	2.6E-03	2.6E+00	2.6E+03
Ce-141	1.8E-02	1.8E+01	1.8E+04
Ce-143	1.0E-01	1.0E+02	1.0E+05
Ce-144	1.7E-03	1.7E+00	1.7E+03
Cf-248	2.0E-05	2.0E-02	2.0E+01

See footnotes at the end of the table.

Table 3-1 Annual Possession Quantities for Environmental Compliance (continued)

Radionuclide	Annual Possession Quantities (Ci/yr) Gaseous Form*	Liquid/ Powder Forms	Solid Form*
Cf-249	1.7E-06	1.7E-03	1.7E+00
Cf-250	4.0E-06	4.0E-03	4.0E+00
Cf-251	1.7E-06	1.7E-03	1.7E+00
Cf-252	6.4E-06	6.4E-03	6.4E+00
Cf-253	3.3E-04	3.3E-01	3.3E+02
Cf-254	3.6E-06	3.6E-03	3.6E+00
Cl-36	1.9E-04	1.9E-01	1.9E+02
Cl-38	6.5E-01	6.5E+02	6.5E+05
Cm-242	6.0E-05	6.0E-02	6.0E+01
Cm-243	3.3E-06	3.3E-03	3.3E+00
Cm-244	4.2E-06	4.2E-03	4.2E+00
Cm-245	2.3E-06	2.3E-03	2.3E+00
Cm-246	2.3E-06	2.3E-03	2.3E+00
Cm-247	2.3E-06	2.3E-03	2.3E+00
Cm-248	6.4E-07	6.4E-04	6.4E-01
Cm-249	4.6E+00	4.6E+03	4.6E+06
Cm-250	1.1E-07	1.1E-04	1.1E-01
Co-56	2.4E-04	2.4E-01	2.4E+02
Co-57	1.6E-03	1.6E+00	1.6E+03
Co-58	9.0E-04	9.0E-01	9.0E+02
Co-58m	1.7E-01	1.7E+02	1.7E+05
Co-60	1.6E-05	1.6E-02	1.6E+01
Co-60m	4.0E+00	4.0E+03	4.0E+06
Co-61	3.8E+00	3.8E+03	3.8E+06
Cr-49	9.0E-01	9.0E+02	9.0E+05
Cr-51	6.3E-02	6.3E+01	6.3E+04
Cs-129	1.5E-01	1.5E+02	1.5E+05
Cs-131	2.8E-01	2.8E+02	2.8E+05
Cs-132	1.3E-02	1.3E+01	1.3E+04
Cs-134	5.2E-05	5.2E-02	5.2E+01
Cs-134m	3.2E-01	3.2E+02	3.2E+05
Cs-135	2.4E-02	2.4E+01	2.4E+04
Cs-136	2.1E-03	2.1E+00	2.1E+03
Cs-137	2.3E-05	2.3E-02	2.3E+01
Cs-138	4.4E-01	4.4E+02	4.4E+05

See footnotes at the end of the table.

Table 3-1 Annual Possession Quantities for Environmental Compliance (continued)

Radionuclide	Annual Possession Quantities (Ci/yr) Gaseous Form*	Liquid/ Powder Forms	Solid Form*
Cu-61	4.0E-01	4.0E+02	4.0E+05
Cu-64	5.2E-01	5.2E+02	5.2E+05
Cu-67	1.5E-01	1.5E+02	1.5E+05
Dy-157	4.4E-01	4.4E+02	4.4E+05
Dy-165	5.6E+00	5.6E+03	5.6E+06
Dy-166	8.1E-02	8.1E+01	8.1E+04
Er-169	4.0E-01	4.0E+02	4.0E+05
Er-171	3.6E-01	3.6E+02	3.6E+05
Es-253	2.6E-04	2.6E-01	2.6E+02
Es-254	2.3E-05	2.3E-02	2.3E+01
Es-254m	1.8E-03	1.8E+00	1.8E+03
Eu-152	1.6E-05	1.6E-02	1.6E+01
Eu-152m	3.5E-01	3.5E+02	3.5E+05
Eu-154	2.0E-05	2.0E-02	2.0E+01
Eu-155	5.2E-04	5.2E-01	5.2E+02
Eu-156	3.2E-03	3.2E+00	3.2E+03
F-18	5.6E-01	5.6E+02	5.6E+05
Fe-52	4.9E-02	4.9E+01	4.9E+04
Fe-55	1.4E-01	1.4E+02	1.4E+05
Fe-59	1.3E-03	1.3E+00	1.3E+03
Fm-254	1.8E-02	1.8E+01	1.8E+04
Fm-255	4.0E-03	4.0E+00	4.0E+03
Fr-223	1.4E-01	1.4E+02	1.4E+05
Ga-66	5.6E-02	5.6E+01	5.6E+04
Ga-67	1.1E-01	1.1E+02	1.1E+05
Ga-68	7.6E-01	7.6E+02	7.6E+05
Ga-72	3.6E-02	3.6E+01	3.6E+04
Gd-152	4.4E-06	4.4E-03	4.4E+00
Gd-153	2.0E-03	2.0E+00	2.0E+03
Gd-159	6.8E-01	6.8E+02	6.8E+05
Ge-68	2.3E-04	2.3E-01	2.3E+02
Ge-71	2.6E+00	2.6E+03	2.6E+06
Ge-77	1.0E-01	1.0E+02	1.0E+05
H-3	1.5E+01	1.5E+04	1.5E+07
Hf-181	2.5E-03	2.5E+00	2.5E+03

See footnotes at the end of the table.

Table 3-1 Annual Possession Quantities for Environmental Compliance (continued)

Radionuclide	Annual Possession Quantities (Ci/yr) Gaseous Form*	Liquid/ Powder Forms	Solid Form*
Hg-193m	9.5E-02	9.5E+01	9.5E+04
Hg-197	2.4E-01	2.4E+02	2.4E+05
Hg-197m	2.5E-01	2.5E+02	2.5E+05
Hg-203	5.2E-03	5.2E+00	5.2E+03
Ho-166	2.8E-01	2.8E+02	2.8E+05
Ho-166m	6.0E-06	6.0E-03	6.0E+00
I-123	4.9E-01	4.9E+02	4.9E+05
I-124	9.3E-03	9.3E+00	9.3E+03
I-125	6.2E-03	6.2E+00	6.2E+03
I-126	3.7E-03	3.7E+00	3.7E+03
I-128	9.3E+00	9.3E+03	9.3E+06
I-129	2.6E-04	2.6E-01	2.6E+02
I-130	4.6E-02	4.6E+01	4.6E+04
I-131	6.7E-03	6.7E+00	6.7E+03
I-132	2.0E-01	2.0E+02	2.0E+05
I-133	6.7E-02	6.7E+01	6.7E+04
I-134	3.2E-01	3.2E+02	3.2E+05
I-135	1.2E-01	1.2E+02	1.2E+05
In-111	4.9E-02	4.9E+01	4.9E+04
In-113m	2.1E+00	2.1E+03	2.1E+06
In-114m	4.9E-03	4.9E+00	4.9E+03
In-115	2.7E-04	2.7E-01	2.7E+02
In-115m	1.4E+00	1.4E+03	1.4E+06
In-116m	3.5E-01	3.5E+02	3.5E+05
In-117	1.3E+00	1.3E+03	1.3E+06
In-117m	7.6E-02	7.6E+01	7.6E+04
Ir-190	3.5E-03	3.5E+00	3.5E+03
Ir-192	9.7E-04	9.7E-01	9.7E+02
Ir-194	2.5E-01	2.5E+02	2.5E+05
Ir-194m	1.5E-04	1.5E-01	1.5E+02
K-40	6.8E-05	6.8E-02	6.8E+01
K-42	2.9E-01	2.9E+02	2.9E+05
K-43	6.0E-02	6.0E+01	6.0E+04
K-44	4.9E-01	4.9E+02	4.9E+05
Kr-79	7.0E+00	-	-

See footnotes at the end of the table.

Table 3-1 Annual Possession Quantities for Environmental Compliance (continued)

Radionuclide	Annual Possession Quantities (Ci/yr) Gaseous Form*	Liquid/ Powder Forms	Solid Form*
Kr-81	1.8E+02	-	-
Kr-83m	2.0E+04	-	-
Kr-85	8.4E+02	-	-
Kr-85m	1.1E+01	-	-
Kr-87	2.0E+00	-	-
Kr-88	4.2E-01	-	-
La-140	1.6E-02	1.6E+01	1.6E+04
La-141	1.1E+00	1.1E+03	1.1E+06
La-142	2.3E-01	2.3E+02	2.3E+05
Lu-177	1.4E-01	1.4E+02	1.4E+05
Lu-177m	3.5E-04	3.5E-01	3.5E+02
Mg-28	2.1E-02	2.1E+01	2.1E+04
Mn-52	3.5E-03	3.5E+00	3.5E+03
Mn-52m	5.2E-01	5.2E+02	5.2E+05
Mn-53	5.7E-02	5.7E+01	5.7E+04
Mn-54	2.5E-04	2.5E-01	2.5E+02
Mn-56	2.5E-01	2.5E+02	2.5E+05
Mo-93	1.5E-03	1.5E+00	1.5E+03
Mo-99**	5.7E-02	5.7E+01	5.7E+04
Mo-101	8.4E-01	8.4E+02	8.4E+05
Na-22	3.2E-05	3.2E-02	3.2E+01
Na-24	2.6E-02	2.6E+01	2.6E+04
Nb-90	2.5E-02	2.5E+01	2.5E+04
Nb-93m	1.2E-02	1.2E+01	1.2E+04
Nb-94	6.0E-06	6.0E-03	6.0E+00
Nb-95	2.3E-03	2.3E+00	2.3E+03
Nb-95m	2.0E-02	2.0E+01	2.0E+04
Nb-96	2.5E-02	2.5E+01	2.5E+04
Nb-97	1.0E+00	1.0E+03	1.0E+06
Nd-147	3.0E-02	3.0E+01	3.0E+04
Nd-149	1.1E+00	1.1E+03	1.1E+06
Ni-56	2.0E-03	2.0E+00	2.0E+03
Ni-57	2.1E-02	2.1E+01	2.1E+04
Ni-59	2.2E-02	2.2E+01	2.2E+04
Ni-63	1.4E-01	1.4E+02	1.4E+05

See footnotes at the end of the table.

Table 3-1 Annual Possession Quantities for Environmental Compliance (continued)

Radionuclide	Annual Possession Quantities (Ci/yr) Gaseous Form*	Liquid/ Powder Forms	Solid Form*
Ni-65	7.0E-01	7.0E+02	7.0E+05
Np-235	3.0E-02	3.0E+01	3.0E+04
Np-237	1.8E-06	1.8E-03	1.8E+00
Np-238	1.9E-02	1.9E+01	1.9E+04
Np-239	1.0E-01	1.0E+02	1.0E+05
Np-240	6.5E-01	6.5E+02	6.5E+05
Np-240m	4.7E+00	4.7E+03	4.7E+06
Os-185	9.2E-04	9.2E-01	9.2E+02
Os-191m	9.0E-01	9.0E+02	9.0E+05
Os-191	3.8E-02	3.8E+01	3.8E+04
Os-193	2.9E-01	2.9E+02	2.9E+05
P-32	1.7E-02	1.7E+01	1.7E+04
P-33	1.2E-01	1.2E+02	1.2E+05
Pa-230	6.3E-04	6.3E-01	6.3E+02
Pa-231	8.3E-07	8.3E-04	8.3E-01
Pa-233	9.3E-03	9.3E+00	9.3E+03
Pa-234	9.3E-02	9.3E+01	9.3E+04
Pb-203	8.3E-02	8.3E+01	8.3E+04
Pb-205	1.2E-02	1.2E+01	1.2E+04
Pb-209	1.1E+01	1.1E+04	1.1E+07
Pb-210	5.5E-05	5.5E-02	5.5E+01
Pb-211	1.2E-01	1.2E+02	1.2E+05
Pb-212	6.0E-03	6.0E+00	6.0E+03
Pb-214	1.2E-01	1.2E+02	1.2E+05
Pd-103	2.1E-01	2.1E+02	2.1E+05
Pd-107	8.2E-02	8.2E+01	8.2E+04
Pd-109	9.4E-01	9.4E+02	9.4E+05
Pm-143	7.6E-04	7.6E-01	7.6E+02
Pm-144	1.1E-04	1.1E-01	1.1E+02
Pm-145	5.2E-04	5.2E-01	5.2E+02
Pm-146	4.4E-05	4.4E-02	4.4E+01
Pm-147	2.6E-02	2.6E+01	2.6E+04
Pm-148	1.7E-02	1.7E+01	1.7E+04
Pm-148m	7.6E-04	7.6E-01	7.6E+02
Pm-149	2.8E-01	2.8E+02	2.8E+05

See footnotes at the end of the table.

Table 3-1 Annual Possession Quantities for Environmental Compliance (continued)

Radionuclide	Annual Possession Quantities (Ci/yr) Gaseous Form*	Liquid/ Powder Forms	Solid Form*
Pm-151	1.2E-01	1.2E+02	1.2E+05
Po-210	9.3E-05	9.3E-02	9.3E+01
Pr-142	2.8E-01	2.8E+02	2.8E+05
Pr-143	1.0E-01	1.0E+02	1.0E+05
Pr-144	1.5E+01	1.5E+04	1.5E+07
Pt-191	6.4E-02	6.4E+01	6.4E+04
Pt-193	2.1E-02	2.1E+01	2.1E+04
Pt-193m	4.8E-01	4.8E+02	4.8E+05
Pt-195m	1.4E-01	1.4E+02	1.4E+05
Pt-197	1.1E+00	1.1E+03	1.1E+06
Pt-197m	3.6E+00	3.6E+03	3.6E+06
Pu-236	7.0E-06	7.0E-03	7.0E+00
Pu-237	2.3E-02	2.3E+01	2.3E+04
Pu-238	2.7E-06	2.7E-03	2.7E+00
Pu-239	2.5E-06	2.5E-03	2.5E+00
Pu-240	2.5E-06	2.5E-03	2.5E+00
Pu-241	1.3E-04	1.3E-01	1.3E+02
Pu-242	2.5E-06	2.5E-03	2.5E+00
Pu-243	3.8E+00	3.8E+03	3.8E+06
Pu-244	2.4E-06	2.4E-03	2.4E+00
Pu-245	2.1E-01	2.1E+02	2.1E+05
Pu-246	4.8E-03	4.8E+00	4.8E+03
Ra-223	1.3E-04	1.3E-01	1.3E+02
Ra-224	3.2E-04	3.2E-01	3.2E+02
Ra-225	1.3E-04	1.3E-01	1.3E+02
Ra-226	5.5E-06	5.5E-03	5.5E+00
Ra-228	1.3E-05	1.3E-02	1.3E+01
Rb-81	4.2E-01	4.2E+02	4.2E+05
Rb-83	1.4E-03	1.4E+00	1.4E+03
Rb-84	2.0E-03	2.0E+00	2.0E+03
Rb-86	1.7E-02	1.7E+01	1.7E+04
Rb-87	1.0E-02	1.0E+01	1.0E+04
Rb-88	1.7E+00	1.7E+03	1.7E+06
Rb-89	6.4E-01	6.4E+02	6.4E+05
Re-184	1.8E-03	1.8E+00	1.8E+03

See footnotes at the end of the table.

Table 3-1 Annual Possession Quantities for Environmental Compliance (continued)

Radionuclide	Annual Possession Quantities (Ci/yr) Gaseous Form*	Liquid/ Powder Forms	Solid Form*
Re-184m	3.6E-04	3.6E-01	3.6E+02
Re-186	1.9E-01	1.9E+02	1.9E+05
Re-187	9.3E+00	9.3E+03	9.3E+06
Re-188	3.7E-01	3.7E+02	3.7E+05
Rh-103m	1.7E+02	1.7E+05	1.7E+08
Rh-105	3.4E-01	3.4E+02	3.4E+05
Ru-97	8.3E-02	8.3E+01	8.3E+04
Ru-103	3.1E-03	3.1E+00	3.1E+03
Ru-105	2.9E-01	2.9E+02	2.9E+05
Ru-106	5.9E-04	5.9E-01	5.9E+02
S-35	7.5E-02	7.5E+01	7.5E+04
Sb-117	2.0E+00	2.0E+03	2.0E+06
Sb-122	3.9E-02	3.9E+01	3.9E+04
Sb-124	6.0E-04	6.0E-01	6.0E+02
Sb-125	1.4E-04	1.4E-01	1.4E+02
Sb-126	1.8E-03	1.8E+00	1.8E+03
Sb-126m	7.6E-01	7.6E+02	7.6E+05
Sb-127	2.0E-02	2.0E+01	2.0E+04
Sb-129	1.8E-01	1.8E+02	1.8E+05
Sc-44	1.4E-01	1.4E+02	1.4E+05
Sc-46	4.0E-04	4.0E-01	4.0E+02
Sc-47	1.1E-01	1.1E+02	1.1E+05
Sc-48	1.1E-02	1.1E+01	1.1E+04
Sc-49	1.0E+01	1.0E+04	1.0E+07
Se-73	1.6E-01	1.6E+02	1.6E+05
Se-75	1.1E-03	1.1E+00	1.1E+03
Se-79	6.9E-03	6.9E+00	6.9E+03
Si-31	4.7E+00	4.7E+03	4.7E+06
Si-32	7.2E-04	7.2E-01	7.2E+02
Sm-147	1.4E-05	1.4E-02	1.4E+01
Sm-151	3.5E-02	3.5E+01	3.5E+04
Sm-153	2.4E-01	2.4E+02	2.4E+05
Sn-113	1.9E-03	1.9E+00	1.9E+03
Sn-117m	2.3E-02	2.3E+01	2.3E+04
Sn-119m	2.8E-02	2.8E+01	2.8E+04

See footnotes at the end of the table.

Table 3-1 Annual Possession Quantities for Environmental Compliance (continued)

Radionuclide	Annual Possession Quantities (Ci/yr) Gaseous Form*	Liquid/ Powder Forms	Solid Form*
Sn-123	1.8E-02	1.8E+01	1.8E+04
Sn-125	7.2E-03	7.2E+00	7.2E+03
Sn-126	4.7E-06	4.7E-03	4.7E+00
Sr-82	1.9E-03	1.9E+00	1.9E+03
Sr-85	1.9E-03	1.9E+00	1.9E+03
Sr-85m	1.5E+00	1.5E+03	1.5E+06
Sr-87m	1.2E+00	1.2E+03	1.2E+06
Sr-89	2.1E-02	2.1E+01	2.1E+04
Sr-90	5.2E-04	5.2E-01	5.2E+02
Sr-91	1.2E-01	1.2E+02	1.2E+05
Sr-92	2.5E-01	2.5E+02	2.5E+05
Ta-182	4.4E-04	4.4E-01	4.4E+02
Tb-157	2.2E-03	2.2E+00	2.2E+03
Tb-160	8.4E-04	8.4E-01	8.4E+02
Tc-95	9.0E-02	9.0E+01	9.0E+04
Tc-95m	1.4E-03	1.4E+00	1.4E+03
Tc-96	5.6E-03	5.6E+00	5.6E+03
Tc-96m	7.0E-01	7.0E+02	7.0E+05
Tc-97	1.5E-03	1.5E+00	1.5E+03
Tc-97m	7.2E-02	7.2E+01	7.2E+04
Tc-98	6.4E-06	6.4E-03	6.4E+00
Tc-99	9.0E-03	9.0E+00	9.0E+03
Tc-99m	1.4E+00	1.4E+03	1.4E+06
Tc-101	3.8E+00	3.8E+03	3.8E+06
Te-121	6.0E-03	6.0E+00	6.0E+03
Te-121m	5.3E-04	5.3E-01	5.3E+02
Te-123	1.2E-03	1.2E+00	1.2E+03
Te-123m	2.7E-03	2.7E+00	2.7E+03
Te-125m	1.5E-02	1.5E+01	1.5E+04
Te-127	2.9E+00	2.9E+03	2.9E+06
Te-127m	7.3E-03	7.3E+00	7.3E+03
Te-129	6.5E+00	6.5E+03	6.5E+06
Te-129m	6.1E-03	6.1E+00	6.1E+03
Te-131	9.4E-01	9.4E+02	9.4E+05
Te-131m	1.8E-02	1.8E+01	1.8E+04

See footnotes at the end of the table.

Table 3-1 Annual Possession Quantities for Environmental Compliance (continued)

Radionuclide	Annual Possession Quantities (Ci/yr) Gaseous Form*	Liquid/ Powder Forms	Solid Form*
Te-132	6.2E-03	6.2E+00	6.2E+03
Te-133	1.2E+00	1.2E+03	1.2E+06
Te-133m	2.9E-01	2.9E+02	2.9E+05
Te-134	4.4E-01	4.4E+02	4.4E+05
Th-226	3.0E-02	3.0E+01	3.0E+04
Th-227	6.4E-05	6.4E-02	6.4E+01
Th-228	2.9E-06	2.9E-03	2.9E+00
Th-229	4.9E-07	4.9E-04	4.9E-01
Th-230	3.2E-06	3.2E-03	3.2E+00
Th-231	8.4E-01	8.4E+02	8.4E+05
Th-232	6.0E-07	6.0E-04	6.0E-01
Th-234	2.0E-02	2.0E+01	2.0E+04
Ti-44	5.2E-06	5.2E-03	5.2E+00
Ti-45	4.0E-01	4.0E+02	4.0E+05
Tl-200	4.4E-02	4.4E+01	4.4E+04
Tl-201	1.8E-01	1.8E+02	1.8E+05
Tl-202	1.0E-02	1.0E+01	1.0E+04
Tl-204	2.5E-02	2.5E+01	2.5E+04
Tm-170	2.4E-02	2.4E+01	2.4E+04
Tm-171	5.9E-02	5.9E+01	5.9E+04
U-230	5.0E-05	5.0E-02	5.0E+01
U-231	1.4E-01	1.4E+02	1.4E+05
U-232	1.3E-06	1.3E-03	1.3E+00
U-233	7.6E-06	7.6E-03	7.6E+00
U-234	7.6E-06	7.6E-03	7.6E+00
U-235	7.0E-06	7.0E-03	7.0E+00
U-236	8.4E-06	8.4E-03	8.4E+00
U-237	4.7E-02	4.7E+01	4.7E+04
U-238	8.6E-06	8.6E-03	8.6E+00
U-239	8.3E+00	8.3E+03	8.3E+06
U-240	1.8E-01	1.8E+02	1.8E+05
V-48	1.4E-03	1.4E+00	1.4E+03
V-49	1.3E+00	1.3E+03	1.3E+06
W-181	1.1E-02	1.1E+01	1.1E+04
W-185	1.6E-01	1.6E+02	1.6E+05

See footnotes at the end of the table.

Table 3-1 Annual Possession Quantities for Environmental Compliance (continued)

Radionuclide	Annual Possession Quantities (Ci/yr) Gaseous Form*	Liquid/ Powder Forms	Solid Form*
W-187	1.1E-01	1.1E+02	1.1E+05
W-188	1.0E-02	1.0E+01	1.0E+04
Xe-122	7.6E-02	7.6E+01	7.6E+04
Xe-123	1.6E+00	1.6E+03	1.6E+06
Xe-125	6.0E-01	-	-
Xe-127	7.0E+00	-	-
Xe-129m	7.6E+01	-	-
Xe-131m	2.2E+02	-	-
Xe-133	5.2E+01	-	-
Xe-133m	6.0E+01	-	-
Xe-135	7.6E+00	-	-
Xe-135m	4.2E+00	-	-
Xe-138	9.9E-01	-	-
Y-86	2.8E-02	2.8E+01	2.8E+04
Y-87	2.3E-02	2.3E+01	2.3E+04
Y-88	2.5E-04	2.5E-01	2.5E+02
Y-90	1.1E-01	1.1E+02	1.1E+05
Y-90m	4.3E-01	4.3E+02	4.3E+05
Y-91	1.8E-02	1.8E+01	1.8E+04
Y-91m	1.6E+00	1.6E+03	1.6E+06
Y-92	7.0E-01	7.0E+02	7.0E+05
Y-93	3.8E-01	3.8E+02	3.8E+05
Yb-169	5.5E-03	5.5E+00	5.5E+03
Yb-175	2.1E-01	2.1E+02	2.1E+05
Zn-62	8.6E-02	8.6E+01	8.6E+04
Zn-65	4.4E-04	4.4E-01	4.4E+02
Zn-69	2.7E+01	2.7E+04	2.7E+07
Zn-69m	2.0E-01	2.0E+02	2.0E+05
Zr-86	2.4E-02	2.4E+01	2.4E+04
Zr-88	2.7E-04	2.7E-01	2.7E+02
Zr-89	1.6E-02	1.6E+01	1.6E+04
Zr-93	2.8E-03	2.8E+00	2.8E+03
Zr-95	6.4E-04	6.4E-01	6.4E+02
Zr-97	4.6E-02	4.6E+01	4.6E+04

* Radionuclides boiling at 100 °C or less, or exposed to a temperature of 100 °C or more, must be considered to be a gas.
** Mo-99 contained in a generator to produce technetium-99 can be assumed to be a solid.

WORKSHEET C - CONCENTRATION TABLE

INTRODUCTION

The Concentration Table provides another simple method for determining compliance and exemption from reporting by using measured concentrations of each nuclide in each stack or vent. You may use this worksheet only if both of the following conditions are satisfied:

1. All of your releases are from stacks or vents and you have measured values of the concentrations. The measurements must have been made using EPA-approved methods (EPA89b).

2. The distance between each stack or vent and the nearest receptor must be greater than 3 times the diameter of the stack or vent. See Figure 3-1 for the definition of this distance. If the stack or vent is not circular, you can determine its diameter from $D = (1.3A)^{1/2}$, where A is the area of the stack or vent.

EXPLANATION OF WORKSHEET C ITEMS

1. Enter the name of each nuclide being released. If the same nuclide is released from more than one stack or vent, enter its name only once.

2. Enter the average annual concentration of each nuclide listed in step 1. If the same nuclide is released from more than one stack or vent, enter the highest concentration of that nuclide in any stack or vent. Concentration measurements must be based on EPA-approved measurement techniques (EPA89b). Use of alternative techniques must have prior approval of the EPA.

In some cases, concentrations are measured in terms of gross alpha or gross beta activity. These measurements may be used to determine the concentrations of the individual radionuclides that produce the gross activity measurement. However, you must justify the method you use to do this, and it is allowed only when the effluent is known to contain only a single nuclide, or the identity and isotopic ratio of a mixture of nuclides are well known.

If you cannot determine the individual concentrations of the gross activity measurements, you must assume that all the activity is that of the most hazardous nuclide that could be present. To determine which nuclide is the most hazardous, find the nuclide among your releases that has the smallest concentration in Table 3-2. The concentration of gross activity in the stack is then taken to be that nuclide's.

3. If you use radionuclides that are not listed in Table 3-2, contact the EPA.

4. Self-explanatory.

5. Self-explanatory.

6. The division by 4 accounts for the frequency with which the wind blows in any given direction.

7. Self-explanatory.

8. See explanation to 6 above.

WORKSHEET C - CONCENTRATION TABLE

Facility Name: _____

Assessment Period (dates): _____

1. Enter the name of each nuclide; i.e., I-131, Co-60, etc.	_____	_____	_____
2. Enter the maximum concentration of each nuclide (Ci/m^3).	_____	_____	_____
3. Enter the concentration of each nuclide from Table 3-2.	_____	_____	_____
4. Divide line 2 by line 3.	_____	_____	_____
5. Sum the fractions on line 4.		_____	
6. Divide line 5 by 4.0.		_____	
7. Sum the fractions on line 4 that are due to radioiodines.		_____	
8. Divide line 7 by 4.0.		_____	

If the value on line 6 is less than 0.1 and the value on line 8 is less than 0.03 and both represent the dose caused by the entire facility with any new construction or modification, you are exempt from reporting or submitting an application to construct or modify. If the value on line 6 is less than 0.01 and the value on line 8 is less than 0.003 and both represent the dose caused only by any new construction or modification, you are exempt from applying for an application to construct or modify that would otherwise be required under 40 CFR 61, Subpart I. Retain this worksheet for possible review by the EPA.

If the value on line 6 is equal to or greater than 0.1 but less than or equal to 1.0, and the value on line 8 is equal to or greater than 0.03 but less than or equal to 0.3, you are in compliance but are not exempt from reporting to the EPA. If the value on line 6 is equal to or greater than 0.01, or the

value on line 8 is equal to or greater than 0.003, and both represent the dose caused only by any new construction or modification, you are not exempt from reporting to the EPA. You may, if you like, use a different method to determine if you are exempt. Retain this worksheet for possible use later.

If the value on line 6 is greater than 1.0 or the value on line 8 is greater than 0.3, you have not demonstrated compliance. You should use another method to determine if you can meet the standard.

Table 3-2. Concentration Levels for Environmental Compliance

Radionuclide	Concentration (Ci/m^3)	Radionuclide	Concentration (Ci/m^3)
Ac-225	9.1E-14	Bi-207	1.0E-14
Ac-227	1.6E-16	Bi-210	2.9E-13
Ac-228	3.7E-12	Bi-212	5.6E-11
Ag-106	1.9E-09	Bi-213	7.1E-11
Ag-106m	1.2E-12	Bi-214	1.4E-10
Ag-108m	7.1E-15	Bk-249	5.6E-13
Ag-110m	9.1E-14	Bk-250	9.1E-11
Ag-111	2.5E-12	Br-77	4.2E-11
Al-26	4.8E-15	Br-80	1.4E-08
Am-241	1.9E-15	Br-80m	1.8E-09
Am-242	1.5E-11	Br-82	1.2E-11
Am-242m	2.0E-15	Br-83	1.2E-08
Am-243	1.8E-15	Br-84	6.7E-10
Am-244	4.0E-11	C-11	1.5E-09
Am-245	8.3E-09	C-14	1.0E-11
Am-246	1.2E-09	Ca-41	4.2E-13
Ar-37	1.6E-03	Ca-45	1.3E-12
Ar-41	1.7E-09	Ca-47	2.4E-12
As-72	2.4E-11	Cd-109	5.9E-13
As-73	1.1E-11	Cd-113	9.1E-15
As-74	2.2E-12	Cd-113m	1.7E-14
As-76	5.0E-11	Cd-115	1.6E-11
As-77	1.6E-10	Cd-115m	8.3E-13
At-211	1.1E-11	Cd-117	6.7E-11
Au-193	3.8E-10	Cd-117m	1.6E-10
Au-194	3.2E-11	Ce-139	2.6E-12
Au-195	3.1E-12	Ce-141	6.3E-12
Au-198	2.1E-11	Ce-143	3.0E-11
Au-199	4.8E-11	Ce-144	6.2E-13
Ba-131	7.1E-12	Cf-248	1.8E-14
Ba-133	5.9E-14	Cf-249	1.4E-15
Ba-133m	5.9E-11	Cf-250	3.2E-15
Ba-135m	1.8E-10	Cf-251	1.4E-15
Ba-139	5.6E-09	Cf-252	5.6E-15
Ba-140	1.3E-12	Cf-253	3.1E-13
Ba-141	1.4E-09	Cf-254	3.0E-15
Ba-142	1.3E-09	Cl-36	2.7E-15
Be-7	2.3E-11	Cl-38	7.7E-10
Be-10	1.6E-12	Cm-242	5.3E-14
Bi-206	2.3E-12	Cm-243	2.6E-15

Table 3-2. Concentration Levels for Environmental Compliance (cont.)

Radionuclide	Concentration (Ci/m^3)	Radionuclide	Concentration (Ci/m^3)
Cm-244	3.3E-15	Eu-156	1.9E-12
Cm-245	1.8E-15	F-18	6.7E-10
Cm-246	1.9E-15	Fe-52	5.6E-11
Cm-247	1.9E-15	Fe-55	9.1E-12
Cm-248	5.0E-16	Fe-59	6.7E-13
Cm-249	3.7E-09	Fm-254	2.0E-11
Cm-250	9.1E-17	Fm-255	4.3E-12
Co-56	1.8E-13	Fr-223	3.3E-11
Co-57	1.3E-12	Ga-66	6.2E-11
Co-58	6.7E-13	Ga-67	7.1E-11
Co-58m	1.2E-10	Ga-68	9.1E-10
Co-60	1.7E-14	Ga-72	3.8E-11
Co-60m	4.3E-09	Gd-152	5.0E-15
Co-61	4.5E-09	Gd-153	2.1E-12
Cr-49	1.1E-09	Gd-159	2.9E-10
Cr-51	3.1E-11	Ge-68	2.0E-13
Cs-129	1.4E-10	Ge-71	2.4E-10
Cs-131	3.3E-11	Ge-77	1.0E-10
Cs-132	4.8E-12	H-3	1.5E-09
Cs-134	2.7E-14	Hf-181	1.9E-12
Cs-134m	1.7E-10	Hg-193m	1.0E-10
Cs-135	4.0E-13	Hg-197	8.3E-11
Cs-136	5.3E-13	Hg-197m	1.1E-10
Cs-137	1.9E-14	Hg-203	1.0E-12
Cs-138	5.3E-10	Ho-166	7.1E-11
Cu-61	4.8E-10	Ho-166m	7.1E-15
Cu-64	5.3E-10	I-123	4.3E-10
Cu-67	5.0E-11	I-124	6.2E-13
Dy-157	5.0E-10	I-125	1.2E-13
Dy-165	6.7E-09	I-126	1.1E-13
Dy-166	1.1E-11	I-128	1.1E-08
Er-169	2.9E-11	I-129	9.1E-15
Er-171	4.0E-10	I-130	4.5E-11
Es-253	2.4E-13	I-131	2.1E-13
Es-254	2.0E-14	I-132	2.3E-10
Es-254m	1.8E-12	I-133	2.0E-11
Eu-152	2.0E-14	I-134	3.8E-10
Eu-152m	3.6E-10	I-135	1.2E-10
Eu-154	2.3E-14	In-111	3.6E-11
Eu-155	5.9E-13	In-113m	2.5E-09

Table 3-2. Concentration Levels for Environmental Compliance (cont.)

Radionuclide	Concentration (Ci/m^3)	Radionuclide	Concentration (Ci/m^3)
In-114m	9.1E-13	Nb-95	2.2E-12
In-115	7.1E-14	Nb-95m	1.4E-11
In-115m	1.6E-09	Nb-96	2.4E-11
In-116m	4.2E-10	Nb-97	1.2E-09
In-117	1.6E-09	Nd-147	7.7E-12
In-117m	9.1E-11	Nd-149	7.1E-10
Ir-190	2.6E-12	Ni-56	1.7E-12
Ir-192	9.1E-13	Ni-57	1.8E-11
Ir-194	1.1E-10	Ni-59	1.5E-11
Ir-194m	1.7E-13	Ni-63	1.4E-11
K-40	2.7E-14	Ni-65	8.3E-10
K-42	2.6E-10	Np-235	2.5E-11
K-43	6.2E-11	Np-237	1.2E-15
K-44	5.9E-10	Np-238	1.4E-11
Kr-79	8.3E-09	Np-239	3.8E-11
Kr-81	2.1E-07	Np-240	7.7E-10
Kr-83m	2.3E-05	Np-240m	5.6E-09
Kr-85	1.0E-06	Os-185	1.0E-12
Kr-85m	1.3E-08	Os-191m	2.9E-10
Kr-87	2.4E-09	Os-191	1.1E-11
Kr-88	5.0E-10	Os-193	9.1E-11
La-140	1.2E-11	P-32	3.3E-13
La-141	7.7E-10	P-33	2.4E-12
La-142	2.7E-10	Pa-230	3.2E-13
Lu-177	2.4E-11	Pa-231	5.9E-16
Lu-177m	3.6E-13	Pa-233	4.8E-12
Mg-28	1.5E-11	Pa-234	1.1E-10
Mn-52	2.8E-12	Pb-203	6.2E-11
Mn-52m	6.2E-10	Pb-205	5.6E-12
Mn-53	1.5E-11	Pb-209	1.3E-08
Mn-54	2.8E-13	Pb-210	2.8E-15
Mn-56	2.9E-10	Pb-211	1.4E-10
Mo-93	1.1E-12	Pb-212	6.3E-12
Mo-99	1.4E-11	Pb-214	1.2E-10
Mo-101	1.0E-09	Pd-103	3.8E-11
Na-22	2.6E-14	Pd-107	3.1E-11
Na-24	2.6E-11	Pd-109	4.8E-10
Nb-90	2.6E-11	Pm-143	9.1E-13
Nb-93m	1.0E-11	Pm-144	1.3E-13
Nb-94	7.1E-15	Pm-145	6.2E-13

Table 3-2. Concentration Levels for Environmental Compliance (cont.)

Radionuclide	Concentration (Ci/m^3)	Radionuclide	Concentration (Ci/m^3)
Pm-146	5.3E-14	Re-184m	3.7E-13
Pm-147	1.1E-11	Re-186	1.8E-11
Pm-148	5.0E-12	Re-187	2.6E-10
Pm-148m	6.7E-13	Re-188	1.7E-10
Pm-149	4.2E-11	Rh-103m	2.1E-07
Pm-151	7.1E-11	Rh-105	1.3E-10
Po-210	7.1E-15	Ru-97	6.7E-11
Pr-142	1.1E-10	Ru-103	2.6E-12
Pr-143	7.1E-12	Ru-105	2.8E-10
Pr-144	1.8E-08	Ru-106	3.4E-13
Pt-191	4.3E-11	S-35	1.3E-12
Pt-193	1.8E-11	Sb-117	2.4E-09
Pt-193m	4.8E-11	Sb-122	1.4E-11
Pt-195m	3.2E-11	Sb-124	5.3E-13
Pt-197	4.0E-10	Sb-125	1.6E-13
Pt-197m	2.6E-09	Sb-126	1.4E-12
Pu-236	5.9E-15	Sb-126m	9.1E-10
Pu-237	1.9E-11	Sb-127	7.1E-12
Pu-238	2.1E-15	Sb-129	7.7E-11
Pu-239	2.0E-15	Sc-44	1.7E-10
Pu-240	2.0E-15	Sc-46	4.2E-13
Pu-241	1.0E-13	Sc-47	3.8E-11
Pu-242	2.0E-15	Sc-48	9.1E-12
Pu-243	4.2E-09	Sc-49	1.2E-08
Pu-244	2.0E-15	Se-73	1.7E-10
Pu-245	2.1E-10	Se-75	1.7E-13
Pu-246	2.2E-12	Se-79	1.1E-13
Ra-223	4.2E-14	Si-31	5.6E-09
Ra-224	1.5E-13	Si-32	3.4E-14
Ra-225	5.0E-14	Sm-147	1.4E-14
Ra-226	3.3E-15	Sm-151	2.1E-11
Ra-228	5.9E-15	Sm-153	5.9E-11
Rb-81	5.0E-10	Sn-113	1.4E-12
Rb-83	3.4E-13	Sn-117m	5.6E-12
Rb-84	3.6E-13	Sn-119m	5.3E-12
Rb-86	5.6E-13	Sn-123	1.1E-12
Rb-87	1.6E-13	Sn-125	1.7E-12
Rb-88	2.1E-09	Sn-126	5.3E-15
Rb-89	7.1E-10	Sr-82	6.2E-13
Re-184	1.5E-12	Sr-85	1.8E-12

Table 3-2. Concentration Levels for Environmental Compliance (cont.)

Radionuclide	Concentration (Ci/m^3)	Radionuclide	Concentration (Ci/m^3)
Sr-85m	1.6E-09	Th-232	6.2E-16
Sr-87m	1.4E-09	Th-234	2.2E-12
Sr-89	1.8E-12	Ti-44	6.2E-15
Sr-90	1.9E-14	Ti-45	4.8E-10
Sr-91	9.1E-11	Tl-200	4.5E-11
Sr-92	2.9E-10	Tl-201	1.0E-10
Ta-182	4.5E-13	Tl-202	5.0E-12
Tb-157	2.5E-12	Tl-204	1.2E-12
Tb-160	7.7E-13	Tm-170	3.3E-12
Tc-95	1.0E-10	Tm-171	2.6E-11
Tc-95m	1.4E-12	U-230	1.5E-14
Tc-96	5.6E-12	U-231	4.2E-11
Tc-96m	6.7E-10	U-232	1.3E-15
Tc-97	7.1E-13	U-233	7.1E-15
Tc-97m	7.1E-12	U-234	7.7E-15
Tc-98	6.7E-15	U-235	7.1E-15
Tc-99	1.4E-13	U-236	7.7E-15
Tc-99m	1.7E-09	U-237	1.0E-11
Tc-101	4.5E-09	U-238	8.3E-15
Te-121	1.0E-12	U-239	4.3E-09
Te-121m	1.2E-13	U-240	1.3E-10
Te-123	1.4E-13	V-48	1.0E-12
Te-123m	2.0E-13	V-49	1.6E-10
Te-125m	3.6E-13	W-181	6.7E-12
Te-127	1.0E-09	W-185	2.6E-12
Te-127m	1.5E-13	W-187	7.7E-11
Te-129	7.7E-09	W-188	5.3E-13
Te-129m	1.4E-13	Xe-122	9.1E-11
Te-131	9.1E-11	Xe-123	1.6E-09
Te-131m	1.0E-12	Xe-125	1.1E-11
Te-132	7.1E-13	Xe-127	8.3E-09
Te-133	9.1E-10	Xe-129m	9.1E-08
Te-133m	2.2E-10	Xe-131m	2.6E-07
Te-134	5.3E-10	Xe-133	6.2E-08
Th-226	3.4E-11	Xe-133m	7.1E-08
Th-227	3.8E-14	Xe-135	9.1E-09
Th-228	3.1E-15	Xe-135m	5.0E-09
Th-229	5.3E-16	Xe-138	1.2E-09
Th-230	3.4E-15	Y-86	3.0E-11
Th-231	2.9E-10	Y-87	1.7E-11

Table 3-2. Concentration Levels for Environmental Compliance (cont.)

Radionuclide	Concentration (Ci/m^3)	Radionuclide	Concentration (Ci/m^3)
Y-88	2.7E-13	Zn-65	9.1E-14
Y-90	1.3E-11	Zn-69	3.2E-08
Y-90m	1.9E-10	Zn-69m	1.7E-10
Y-91	2.1E-12	Zr-86	2.4E-11
Y-91m	1.3E-09	Zr-88	3.1E-13
Y-92	8.3E-10	Zr-89	1.3E-11
Y-93	2.9E-10	Zr-93	2.6E-12
Yb-169	3.7E-12	Zr-95	6.7E-13
Yb-175	4.3E-11	Zr-97	3.8E-11
Zn-62	9.1E-11		

WORKSHEET D - STACK OR VENT CHARACTERISTICS

INTRODUCTION

Worksheet D is provided for use in keeping track of the various release points. Even if your facility has no releases from stacks or vents*, fill out this worksheet.

If you have many release points and would like to reduce book-keeping requirements, you may assume that all the radionuclides from your facility are released from the stack or vent having the potential for causing the highest dose. Similarly, you may assume that all the release points from a building can be replaced by a single stack or vent having the potential for causing the highest dose. In either case, the stack or vent having the potential for causing the highest dose must be determined by running COMPLY with a unit release of any one of your radionuclides from a selection of stacks or vents. The selection should be based on factors such as distance to the receptor, building configuration and meteorological data if a wind rose is used. If you consolidate releases, you must make the stack or vent height no greater than the building height. Alternative procedures for consolidating releases may be used if you have approval from the EPA.

If none of your releases are from stacks or vents, write in "no stacks" on line 1. On line 2 put N/A. Enter 0.03 on line 3 and 0.1 on line 4. Enter a 1 on line 5.

* The calculations do not distinguish between a stack and a vent. We include both terms for completeness.

EXPLANATION OF WORKSHEET D ITEMS

1. Self-explanatory.

2. This item is for your own use in identifying which release point is which. For example, you might enter "Roof vent from building X" here.

3. This is the volumetric flow rate out of the stack. If you do not have measured flow rates, use the name plate rating of the fan. If the temperature of the air flowing through the stack or vent is significantly different from that of the air flowing through the fan, the volumetric flow rate up the stack will be different than that through the fan. With a 100-degree Fahrenheit temperature difference, the change in flow could be on the order of 20 percent.

   The correction for temperature is as follows:

$$Q_{stack} = Q_{fan}(T_{stack}/T_{fan})$$

   where the Qs are the flow rates and the Ts are the absolute temperatures (degrees C + 273 or degrees F + 460).

4. This is the inside diameter at the point of release. If the stack or vent is not circular, determine its equivalent circular diameter from

$$D = (1.3A)^{1/2}$$, where A is the stack flow area.

5. The stack height is the distance from the ground to the top of the stack or the center of a vent from the side of a building. See Figure 3-2 at the end of this section.

6. See Figure 3-1.

7. This is needed only when you use level 4 of the COMPLY code. It should be the annual average.

8. This is needed only when you use level 4 of the COMPLY code. It should be the average temperature during the operation.

WORKSHEET D - STACK OR VENT CHARACTERISTICS

Facility Name: _____

Assessment Period (dates): _____

	1	2	3
1. Stack number (to keep track of each stack as you proceed)			
2. Stack or vent identity (for your information only)	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
3. Stack flow rate, m^3/s(A)	_____	_____	_____
4. Stack inside diameter, m	_____	_____	_____
5. Stack height, m	_____	_____	_____
6. Distance to closest resident, m(B)	_____	_____	_____
7. Ambient air temp., ^oF(C)		_____	
8. Stack gas temp., ^oF(C)	_____	_____	_____

(A) To obtain m^3/sec from cfm, multiply cfm by 4.72×10^{-4}.

(B) Not needed if wind rose used (level 4 of COMPLY code).

(C) Needed only for level 4 of COMPLY code.

WORKSHEET E - RELEASE RATES

INTRODUCTION

Release rates are needed if you either calculate dose by hand or use the computer code to determine whether you are in compliance with the standard. Release rates from tailing piles should be calculated using procedures described in NRC87. Otherwise, use this to calculate release rates.

You will need the information in 1, 2, or 3 below.

1. The average annual release rate for each nuclide in each stack or vent (curies/year).

or

2(a). The average annual concentration of each nuclide measured in each stack or vent (curies/m^3), and

2(b). The stack flow rate (in cubic meters/second).

or

3(a). The annual possession quantities from line 4 of Worksheet B, and

3(b). The physical form of each radionuclide from line 5 of Worksheet B.

You will need either NCRP Commentary No. 3 or the User's Guide for the COMPLY Code. See Section 5.2, Sources, for information on how obtain these documents and the COMPLY code.

EXPLANATION OF WORKSHEET E ITEMS

1. You will need to complete one of these worksheets for each stack or vent. If you have more than one stack or vent, complete Worksheet D.

2. If you intend to use the measured stack concentrations or the measured release rates, enter the name of each nuclide being released. If you intend to use the annual possession amounts to compute the release rates (steps 7-12) and a nuclide is in more than one physical form (gas, liquid or powder, or solid), enter its name once for each physical form. See the explanation for line 5 of Worksheet B for restrictions on these physical forms.

3. Release rate measurements must be based on EPA-approved measurement techniques (EPA89b). Use of alternative techniques must have prior approval from the EPA.

   In some cases, concentration measurements are made in terms of gross alpha or gross beta activity. These may be used to determine the concentrations of the individual radionuclides that produce the gross activity measurement. However, you must justify the method you use to do this, and it is allowed only when the effluent is known to contain only a single nuclide, or the identity and isotopic ratio of a mixture of nuclides are well known.

   If you cannot determine the individual concentrations from the gross activity measurements, you must assume that all the activity is that of the most hazardous nuclide that could be present. To determine which nuclide is the most

hazardous, find the nuclide among your releases that has the smallest concentration in Table 3-2. The concentration of gross activity in the stack is then taken to be that nuclide's.

4. Concentration measurements must be based on EPA-approved measurement techniques (EPA89b). If your measurements are in terms of gross alpha or gross beta activity, see item 3 above.

5. This is the volumetric flow rate up the stack or vent in cubic meters/year. If your flow rate is in terms of m^3/s, multiply by 3.2×10^7 to get m^3/yr. If your flow is in terms of ft^3/min, multiply by 1.5×10^4 to get m^3/yr.

6. Self-explanatory.

7. If you have neither measured release rates nor measured concentrations, you may use the annual possession quantities to estimate the release rates. Fill out lines 1-4 of Worksheet B (if you have not already done so) and enter the values from line 4 of Worksheet B here. You can link a particular quantity to a particular stack or vent only if you can justify it. For example, if a specific area is vented only through a given stack, and you know the amounts on hand and the amounts received for that area, then you may calculate the concentration for that stack from that possession quantity. Otherwise, you must assume that all the nuclides escape through the stack nearest to the closest receptor.

8. This must be a gas, a liquid or powder, or a solid.

If any nuclide is exposed to a temperature of 100 degrees Celsius or more, or boils at temperatures of 100 degrees Celsius or less, it must be considered a gas.

9. Self-explanatory.

10. Enter the appropriate values from Table 3-3. If there are no control devices, enter 1.0.

11. Self-explanatory.

12. Sum the release rates for nuclides having the same name. For example, if on line 2, I-131 was listed twice because you have it in both the liquid and solid form, add the two I-131 release rates together.

13. There should be a worksheet for each stack or vent.

WORKSHEET E - RELEASE RATES

Facility Name: _____

Assessment Period (dates): _____

1. Stack No. _____ of _____

2. Enter the name of each nuclide (i.e., I-131, Co-60, etc.).	_____	_____	_____
3. If you have measured release rates (Ci/yr) using EPA-approved techniques, enter them and go to line 12. Otherwise go to line 4.	_____	_____	_____
4. If you have measured concentrations (Ci/m^3) by EPA-approved methods, enter them. Otherwise go to line 7.	_____	_____	_____
5. Enter the stack flow rate, m^3/yr. If you do not know the flow rate, go to line 7.	_____	_____	_____
6. Multiply the values on line 4 by the flow rate on line 5. These are the release rates (Ci/yr). Go to line 12.	_____	_____	_____
7. If you do not have measured concentrations or release rates, enter the annual possession amounts (Ci) from line 4 of Worksheet B. If you have not filled out lines 1-4 of Worksheet B, do so now.	_____	_____	_____

Worksheet E (page 2 of 2)

Facility Name: _____

Assessment Period (dates): _____

Stack No. _____of_____

8. Enter the physical form of each nuclide from line 5 of Worksheet B.	_____	_____	_____
9. For each nuclide, enter 1.0 if line 8 is a gas, 0.001 if line 8 is a liquid or powder, or 10^{-6} if line 8 is a solid.	_____	_____	_____
10. Enter the appropriate values from Table 3-3. Enter 1.0 if there are no controls.	_____	_____	_____
11. Multiply line 7 by lines 9 and 10. These are the release rates in Ci/year.	_____	_____	_____
12. Sum the release rates for nuclides having the same name.	_____	_____	_____

13. Repeat this worksheet for each stack or vent if you have more than one.

Use the release rates on line 11 or 12 as input for either the hand calculations described in NCRP Commentary No. 3, or the COMPLY computer code.

Table 3-3. Adjustments to emission factors for effluent controls

Control	Types of Radionuclides Controlled	Adjustment Factor to Emissions	Comments and Conditions
HEPA Filters	Particulates	0.01	Not applicable to gaseous radionuclides; periodic testing is prudent to ensure high removal efficiency
Fabric Filters	Particulates	0.1	Monitoring would be prudent to guard against tears in filter
Sintered Metal Filters	Particulates	1	Insufficient data to make recommendation
Activated Carbon Filters	Iodine Gas	0.1	Efficiency is time dependent; monitoring is necessary to ensure effectiveness
Douglas Bags: Held one week or longer for decay	Xenon	0.5/wk	Based on xenon half-life of 5.3 days;
Released within one week	Xenon	1	Provides no reduction of exposure to general public

Table 3-3. Adjustments to emission factors for effluent controls

Control	Types of Airborne Radionuclides Controlled	Adjustment Factor to Emissions	Comments and Conditions
Venturi Scrubbers	Particulates	0.05	Although venturis may remove gases, variability in gaseous removal efficiency dictates adjustment factor for particulates only
	Gases	1	
Packed Bed Scrubbers	Gases	0.1	Not applicable to particulates
Electrostatic Precipitators	Particulates	0.05	Not applicable for gaseous radionuclides
Xenon Traps	Xenon	0.1	Efficiency is time dependent; monitoring is necessary to ensure effectiveness
Fume Hoods	All	1	Provides no reduction to general public exposures
Vent Stacks	All	1	Generally provides no reduction of exposure to general public

WORKSHEET F - COMPLY Code and NCRP COMMENTARY NO. 3

Facility Name: _____

Assessment Period (dates): _____

This worksheet describes how to interpret both the output of the COMPLY computer code, and the results from the calculations of NCRP Commentary No. 3. Note that certain steps of NCRP Commentary No. 3 are not needed for this application. Follow the instructions in NCRP Commentary No. 3 except as noted below.

Basis for Compliance

The basis for determining whether you are exempt from reporting, in compliance, or not in compliance is as follows: If the effective-dose equivalent from all radionuclides is equal to or less than 10 mrem/yr, and the effective-dose equivalent from radioiodine is equal to or less than 3 mrem/yr, you are in compliance. If the effective-dose equivalent from all radionuclides is less than 1 mrem/yr, and the effective-dose equivalent from all radioiodines is less than 0.3 mrem/yr, and both represent the dose caused by the entire facility including any new construction or modification, you are exempt from reporting or submitting an application to construct or modify to the EPA. If the effective-dose equivalent from all radionuclides is less than 0.1 mrem/yr, and the effective-dose equivalent from all radioiodines is less than 0.03 mrem/yr, and both represent the dose caused by any new construction or modification only, you are exempt from submitting an application to construct or modify.

NCRP Screening Level I

Enter the effective-dose equivalent for all radionuclides here:_____ mrem/yr and for all radioiodines here:_____ mrem/yr. See the Basis for Compliance given above to determine whether you are in compliance or exempt from the reporting requirements.

If you are not in compliance, proceed to Screening Level II of NCRP Commentary No. 3 or use COMPLY. If you are in compliance but are not exempt from reporting, you may wish to proceed to NCRP Screening Level II or use COMPLY to determine if you may be exempt.

COMPLY Level 1 (Possession and Concentration Tables)

Enter the possession or emission fraction for all

radionuclides from COMPLY here _____ and for radioiodines here _____. Follow the instructions given after step 9 of worksheet B. If the fraction is greater than 1.0 for all radionuclides or 0.3 for radioiodines, you have not demonstrated compliance. You should go to Levels 2 - 4 of COMPLY to determine if you can meet the standard.

COMPLY Level 2 or NCRP Screening Level II

If you are using Level 2 of COMPLY or NCRP Commentary No. 3, enter the effective dose equivalent from all radionuclides here:_____ mrem/yr and from radioiodines here:_____ mrem/yr.

See the Basis for Compliance given above to determine whether you are in compliance or exempt from the reporting requirements. If you are in compliance, but are not exempt from reporting, you may wish to proceed to either Level 3 of COMPLY or to NCRP Screening Level III to determine if you may be exempt.

COMPLY Level 3 or NCRP Screening Level III

If you are using Level 3 of COMPLY or NCRP Commentary No. 3, enter the effective-dose equivalent from all radionuclides here:_____ mrem/yr and from radioiodines here:_____ mrem/yr.

See the Basis for Compliance given above to determine whether you are in compliance or exempt from the reporting requirements. If you are in compliance, but are not exempt from reporting, you may wish to proceed to Level 4 of COMPLY to determine if you may be exempt.

COMPLY Level 4

If you are using Level 4 of COMPLY, enter the effective-dose equivalent from all radionuclides here:_____ mrem/yr and from radioiodines here:_____ mrem/yr.

See the Basis for Compliance given above to determine whether you are in compliance or exempt from the reporting requirements. If you are not in compliance, you should contact your EPA radiation representative. See Section 5.

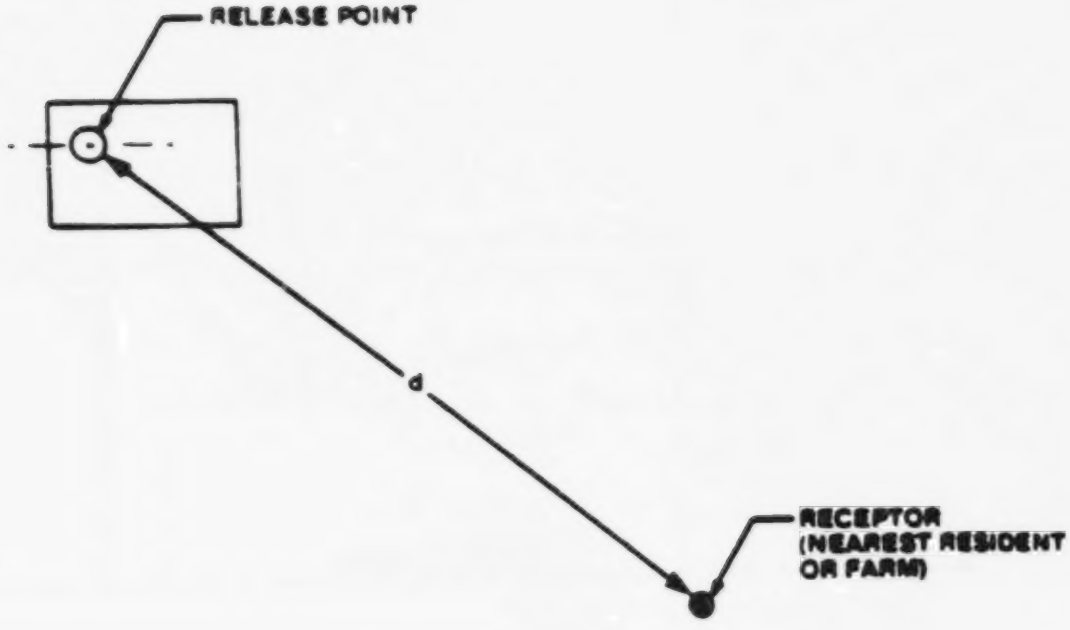


Figure 3-1. Distance between source and nearest receptor or farm

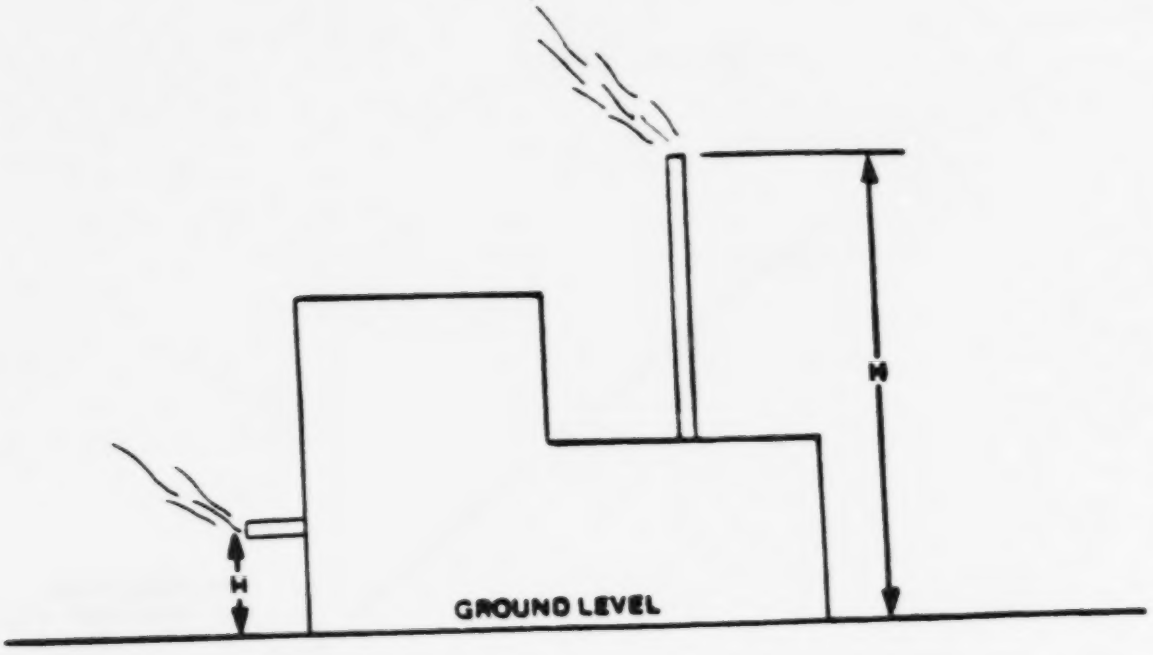


Figure 3-2. Definition of release heights

4. REPORTING AND RECORDKEEPING REQUIREMENTS

4.1 REPORTING REQUIREMENTS

The owner or operator of an existing facility that is not exempt from the reporting requirements must submit an annual report to the EPA. The owner or operator of a new facility or one that is being modified must file an application with the EPA unless his facility is exempt. This report or application must provide the following information:

GENERAL INFORMATION

1. The name of the facility.

2. The name of the person responsible for the operation of the facility and the name of the person preparing the report (if different).

3. The location of the facility, including suite and/or building number, street, city, county, state, and zip code.

4. The mailing address of the facility, if different from item 3.

DESCRIPTION OF THE FACILITY AND NEARBY ENVIRONMENT

5. A list of the radioactive materials used at the facility.

6. A description of the handling and processing that the radioactive materials undergo at the facility.

7. A list of the stacks or vents or other points where radioactive materials are released to the atmosphere.

8. A description of the effluent controls that are used on each stack, vent, or other release point and an estimate of the efficiency of each device.

9. A plan view of the facility identifying:

   a. the points where radioactive materials are released to the air;
   b. the location of the nearest receptor; and
   c. the location of the nearest farm(s) where milk, meat, or vegetables are grown. If the farms are difficult to locate, you may estimate the distance. However, you must be prepared to justify your selection.

10. The effective dose equivalent calculated using the compliance procedures in 61.103.

11. All information required in an application to construct or modify a facility under section 61 subpart A, for all construction and modifications which were completed in the relevant calendar year but for which the requirement to apply for approval to construct or modify was waived under section 61.

PARAMETERS USED IN DOSE CALCULATIONS

Note: You should supply copies of all the Section 3 worksheets used in making your dose estimates.

If you use the COMPLY computer code to make your dose estimates, most of the information listed below will be printed as a part of the output. You may submit a copy of this output as

a part of your report and do not have to submit this information separately. Your report, however, must include sufficient information for the EPA to judge the validity of the input.

If you use NCRP Commentary No. 3 to make your dose estimates, you may submit a copy of the NCRP Commentary No. 3 worksheets as part of your report. You do not have to submit the information on the worksheets separately. Again, your report must include enough information for the EPA to judge the validity of the input used in the calculations.

Not all the parameters listed below are needed for any given facility. You do not have to report any that you do not use.

12. The physical form and quantity of each radionuclide emitted from each stack, vent, or other release point and the method(s) by which these quantities were determined.

13. The volumetric flow, diameter, effluent temperature, and release height for each stack, vent, or other release point where radioactive materials are emitted and the method(s) by which these were determined.

14. The height, length, and width of each building from which radionuclides are emitted.

15. Distances and directions from the point of release to the nearest receptor and the nearest farms producing vegetables, milk, and meat.

16. The values used for all other user-supplied input parameters (e.g., meteorological data) and the source of these data.

If the facility is not in compliance, then the facility must report to the Administrator on a monthly basis. These reports will be due 30 days following the end of each month. This increased level of reporting will continue until the Administrator has determined that the monthly reports are no longer necessary. In addition to all the information required above, monthly reports shall include the following information:

17. All controls or other changes in operation of the facility that will be or are being installed to bring the facility into compliance.

18. If the facility is under a judicial or administrative enforcement decree, the report will describe the facility's performance under the terms of the decree.

4.2 Recordkeeping Requirements

The owner or operator of any facility subject to the standard must maintain records documenting the source of input parameters, the calculations and/or analytical methods used to derive values for input parameters, and the procedure used to determine compliance. In all cases, the documentation should be sufficient to allow an independent auditor to verify whether the facility complies with the standard, and qualifies for exemption from reporting or filing, if claimed. These records must be kept at the site of the facility for at least five years and upon request be made available for inspection by the Administrator, or his authorized representative.

5. RESOLVING PROBLEMS AND CONTACTING THE EPA

5.1 EPA CONTACTS

If you do not understand any steps or have trouble with any of the calculations described in this document, you should contact the Program Manager at your regional EPA office. You should also contact the Program Manager if you are unable to demonstrate compliance after having tried all the methods discussed in this report, including level 4 of the COMPLY code. EPA Regional Offices are depicted in Figure 5-1. A list of the regional EPA Program Managers and their telephone numbers is included as Table 5-1.

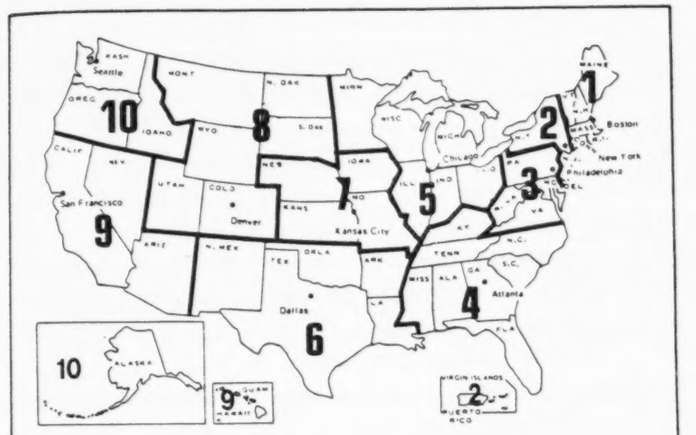
While most facilities will be able to demonstrate compliance by one of the methods described in this report, if none of these methods works for your facility, you should contact the EPA Program Manager at your regional EPA office to determine the next step.

5.2 SOURCES

NCRP Commentary No. 3 may be obtained from the National Council on Radiation Protection and Measurements, 7910 Woodmont Avenue, Bethesda, Maryland 20814. The telephone number is 301-657-2652.

Additional copies of this document, or the User's Guide for the COMPLY Code and 5 1/4-inch diskettes containing the code and all tne data files can be obtained from:

Program Management Office ANR-459
Office of Radiation Programs
Environmental Protection Agency
401 M St., SW
Washington, DC 20460.



Regions	Regions	Regions
4 — Alabama	1 — Maine	3 — Pennsylvania
10 — Alaska	3 — Maryland	1 — Rhode Island
9 — Arizona	1 — Massachusetts	4 — South Carolina
6 — Arkansas	5 — Michigan	8 — South Dakota
9 — California	5 — Minnesota	4 — Tennessee
8 — Colorado	4 — Mississippi	6 — Texas
1 — Connecticut	7 — Missouri	8 — Utah
3 — Delaware	8 — Montana	1 — Vermont
3 — D.C.	7 — Nebraska	3 — Virginia
4 — Florida	9 — Nevada	10 — Washington
4 — Georgia	1 — New Hampshire	3 — West Virginia
9 — Hawaii	2 — New Jersey	5 — Wisconsin
10 — Idaho	6 — New Mexico	8 — Wyoming
5 — Illinois	2 — New York	9 — American Samoa
5 — Indiana	4 — North Carolina	9 — Guam
7 — Iowa	8 — North Dakota	2 — Puerto Rico
7 — Kansas	5 — Ohio	2 — Virgin Islands
4 — Kentucky	6 — Oklahoma	
6 — Louisiana	10 — Oregon	

Figure 5.1 EPA Regional Offices

Table 5-1. EPA Regional Program Managers

	Telephone No.
Tom D'Avanzo Radiation Program Manager, Region 1 Environmental Protection Agency John F. Kennedy Federal Building Boston, MA 02203	FTS: 835-4502 COMM: (617) 565-4502
Paul A Giardina Radiation Program Manager, Region 2 Environmental Protection Agency Room 905A 26 Federal Plaza New York, NY 10278	FTS: 264-4110 COMM: (212) 264-4110
Lewis Felleisen Radiation Program Manager, Region 3 Special Program Section (3AM12) Environmental Protection Agency 841 Chestnut Street Philadelphia, PA 19107	FTS: 597-8326 COMM: (215) 597-8326
Chuck Wakamo Radiation Program Manager, Region 4 Environmental Protection Agency 345 Courtland Street, N.E. Atlanta, GA 30365	FTS: 257-3907 COMM: (404) 347-3907
Gary V. Gulezian Radiation Program Manager, Region 5 Environmental Protection Agency 230 S. Dearborn Street Chicago, Il 60604	FTS: 886-6258 COMM: (312) 353-2206

Table 5-1. EPA Regional Program Managers (continued)

	Telephone No.
Donna Ascenzi Radiation Program Manager, Region 6 Air Program Branch (6t-E) Air, Pesticides and Toxics Division Environmental Protection Agency 1445 Ross Avenue Dallas, TX 75202-2733	FTS: 255-7223 COMM: (214) 655-7223
Carl Walter Radiation Program Manager, Region 7 Environmental Protection Agency 726 Minnesota Avenue Kansas City, KS 66101	FTS: 276-7600 COMM: (913) 551-7600
Milton W. Lammering Radiation Program Manager, Region 8 Environmental Protection Agency Suite 500 999 18th Street Denver, CO 80202-2405	FTS: 330-1713 COMM: (303) 293-1713
Michael S. Bandrowski Radiation Program Manager, Region 9 Environmental Protection Agency 1235 Mission Street San Francisco, CA 94105	FTS: 556-5285 COMM: (415) 556-5285
Jerry Leitch Radiation Program Manager, Region 9 Environmental Protection Agency 1200 Sixth Avenue, Mail Stop AG-082 Seattle, WA 98101	FTS: 399-7660 COMM: (206) 442-7660

REFERENCES

NCRP89, "Screening Techniques for Determining Compliance with Environmental Standards," NCRP Commentary No. 3, National Council on Radiation Protection and Measurements, Revision of January, 1989 with Addendum of October, 1989.

NRC87, "Methods for Estimating Radioactive and Toxic Airborne Source Terms for Uranium Milling Operations," U.S. Nuclear Regulatory Commission Regulatory Guide 3.59, March 1987.

EPA89a, "User's Guide for the Comply Code," EPA 520/1-89-003, U.S. Environmental Protection Agency, Office of Radiation Programs, October 1989.

EPA89b, "Methods for Measuring Radionuclide Emissions from Stationary Sources" as given in 40 CFR Part 61, Appendix B.